"EMERITUS"
AN
ENGINEER-MANAGER'S EVALUATION, REVIEW
AND
IMPROVEMENT TOOL

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"EMERITUS"
An
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A Report in
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by
M.P. Doyle

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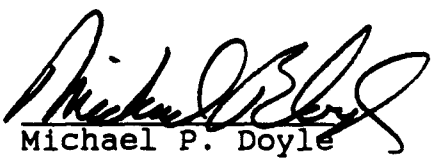

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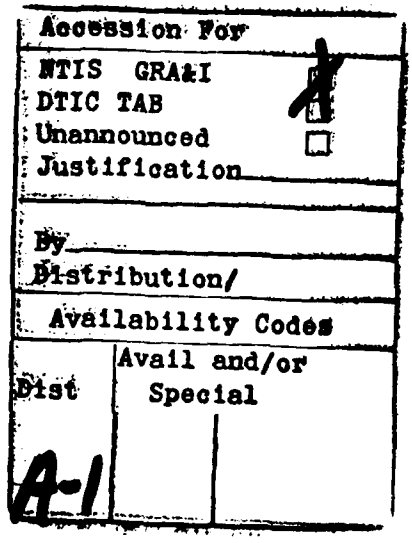

ABSTRACT

The objective of this report is the development of a tool, EMERITUS, to assist the engineer in evaluating, reviewing, and improving his or her performance as an engineer-manager. This report will show that engineers acquire management responsibilities soon after entering the field of engineering, that they spend much of their time performing management related tasks with little or no management training, and that they often mature into engineer-managers with deficient and sometimes counterproductive management skills. The elements of the management process will be reviewed. The key elements of the management process will then be extracted and presented as a tool to assist the engineer.

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ACKNOWLEDGMENTS

I would like to thank Dr. Victor Sanvido for his guidance and advice. He knew when I needed to flounder on my own, when I needed direction, and when I needed a kick in the pants. The faculty, facilities, and courses provided by the Architectural Engineering Department were instrumental in making my time at Penn State enjoyable and productive.

I would especially like to thank my wife, Mary Ellen and my son, Patrick for putting up with a husband and father who always seemed to be too busy working to do any "fun" things. They were both always there when I needed them.

CHAPTER 1

INTRODUCTION

1.1 Engineers as Managers

The success or failure of an engineer depends just as much on management skills as on engineering skills.[1] Almost all engineers take on management responsibilities at various times throughout their careers.[2] Ultimately, almost half of all engineers use management skills more than engineering skills. National Science Foundation Statistics from 1986 state the following:

- 30% of all U.S. engineers describe their primary work activity as management.[3]
- 13% of all U.S. engineers describe their secondary work activity as management.[3]
- 10% of all recent U.S. engineering graduates, less than one year since graduation, describe their primary work activity as management.
- 10% of all recent U.S. engineering graduates, less than one year since graduation, describe their secondary work activity as management.[4]

1.2 Industry Opinion

The widespread opinion within industry in the United States is that the competence of recently graduated engineers in analytical skills and engineering sciences is good, but that they are missing critical management skills. The lack of education in the management of engineering functions (as distinct from MBA-style management) is a definite problem.[5]

1.3 Typical Experiences

Some organizations follow a sink-or-swim approach when giving management responsibilities to engineers. The engineers are given little effective formal or informal preparation and no management training. They are left on their own to devise management skills as the need arises.[6] The otherwise competent engineer often becomes frustrated, and many times this frustration leads to failure.[7]

Left on their own, engineers develop a management style and form concrete ideas, opinions and perceptions of how to handle managerial responsibilities. But without guidance, they inevitably develop bad habits that become increasingly harder to change the longer they are allowed to persist. When eventually, the engineer's organization faces the problem of trying to eliminate those bad

managerial habits and methods, the process becomes painful and sometimes futile. Often the company finds it easier to eliminate the engineer.

1.4 Today's Needs

Today's engineer needs more than traditional undergraduate engineering skills to become a capable professional. Management techniques, tools, and principles are necessary to succeed as an engineer. An engineer's management and technical expertise are the cornerstones upon which the engineer-manager must build a career. The strength of this expertise will ultimately determine the success or failure of the engineer.

This report will introduce engineer-managers to the management processes, and it will help them assess and improve their effectiveness in managing the resources under their control.

1.5 Problem Statement

Engineers are not the best managers.[8] They do not possess the necessary management skills to function effectively and efficiently as engineer-managers, yet many engineers find themselves in positions with managerial duties. The goal of this report is to provide a tool to help engineers become better managers.

1.6 Significance of Problem

Engineers hold key jobs in American industry. The failure of a company to provide adequate management training for its engineer-managers has far reaching and long term effects.

Articles discussing the reasons behind the decline of America's dominant role in many areas of technology and manufacturing point to a number of reasons, but the most common is usually poor management.[9] Management ineffectiveness is considered to be by far the single greatest cause of declining productivity in the United States.[10] The untrained engineer-manager is clearly one of the causes of America's technological decline. But the loss of competitiveness and productivity is not due to a decline in the engineering skills possessed by engineers. The loss is the result of the engineer's lack of management training during a time when the complexities and coordination requirements of the engineer-manager have increased.

Engineers must be proficient in a range of non-technical areas if they are to be successful managers.[11] To remain competitive, the United States must improve the way it manages its resources.[12]

1.7 Scope of Work

This report will provide engineer-managers with a tool to evaluate and improve their performance as managers. It will cover only those management processes and elements that are important to the engineer-manager described below. Limitations on the scope of the tool, and the job that it is designed to assist, are listed below:

The engineer-manager will:

- Work in an established organization.
- Manage an established work group or a temporary project oriented work group.
- Report to another manager.
- Control resources.
- Supervise other workers.
- Operate under set limits of authority and responsibility.

The management tool will:

- Focus on the internal management of the work group.
- Emphasize controlling the input of resources and the output of products.

- o Concentrate on what goes on outside of the work group only to the extent that it affects the work group and the engineer-manager's ability to support the work group.
- o Concern itself with meeting the objectives set by the organization for the work group.

1.8 Objectives

This report will provide engineer-managers with a tool to evaluate and improve their performance as managers. A management improvement checklist will accomplish this task. Specific objectives are:

1.8.1 Review the management processes and the elements of each process as described by general management references.

1.8.2 Select the management elements that are most closely associated with the duties and responsibilities of the engineer-manager described in the scope of work.

1.8.3 Develop a list of questions tied to the selected management elements that help engineer-managers assess their effectiveness in managing the resources and personnel under their control.

1.8.4 Provide solutions and a scoring system to evaluate the engineer-manager's answers to the questions.

1.8.5 Furnish an improvement checklist that will help engineer-managers improve their performance in the management elements selected.

1.8.6 Test the questions and solutions.

1.8.7 Supply a User's Guide to assist the engineer-manager in using this tool.

1.9 Methodology

The goals of the report will be met by selecting and defining key management elements, developing questions, formulating a review and evaluation criteria for the questions, and creating an improvement checklist. The specific steps taken to accomplish these goals will be as follows:

1.9.1 A literature review and the writer's 14 years of experience as an engineer-manager will provide the background necessary to develop the management tool.

1.9.1.1 Review general management references.

1.9.1.2 Determine the management processes and elements described in each reference.

1.9.1.3 Provide an overview of the processes and elements covered in several representative references.

1.9.1.4 Develop a list of the management processes and elements for each reference.

1.9.2 The selection of management elements will be based on the writer's 14 years of experience as an engineer-manager.

1.9.2.1 Select the management elements most relevant to the engineer-manager.

1.9.2.2 Use the scope of work, the literature review, and the writer's personal experiences to make the selection.

1.9.3 The development of non-leading questions will help engineer-managers objectively evaluate their own performance.

1.9.3.1 Develop questions that evaluate the engineer-manager's performance of each management element.

1.9.3.2 Construct questions that are concise, non-leading, and cross check information.

1.9.4 The solutions will be based on the management practices described in the references reviewed.

1.9.4.1 Develop a short solution to each question based on the writer's personal experiences and a review of the management references.

1.9.4.2 Develop a scoring system that is simple and that evaluates each element and overall performance.

1.9.5 The solutions will provide an answer to each question, but will not always readily identify methods to improve that management element. An improvement checklist will give engineer-managers the information they need to improve their performance.

1.9.5.1 Furnish concise, informative statements for each management element that sum up the concepts and explain how to improve management performance.

1.9.5.2 Develop the informative statements from details contained in the references and from the writer's personal experiences.

1.9.6 The management tool will be tested on an engineer-manager and his or her work group to evaluate the utility and thoroughness of the tool. The tool will also be reviewed by one senior engineer-manager, who will provide his or her advice and comments.

1.9.6.1 Select one engineer-manager with 5 to 10 years of experience that has at least 3 people reporting to him or her.

1.9.6.1.1 Use the tool to evaluate the engineer-manager's performance.

1.9.6.1.2 Provide the engineer-manager with the results of the test.

1.9.6.1.3 Have the engineer-manager review the improvement checklist.

1.9.6.1.4 Have the engineer-manager comment on the usefulness of the tool in evaluating his or her management performance.

1.9.6.2 Select one senior engineer-manager with a background in management to review and comment on the management tool.

1.9.6.3 Adjust the questions, solutions or improvement checklist based on their comments.

1.9.7 To help the engineer-manager use the tool a users guide will be developed.

1.9.7.1 Provide instructions for engineer-managers on how to prepare for and administer the questions.

1.9.7.2 Furnish instructions for engineer-managers on how to evaluate the results.

1.10 Summary of Chapters

Chapter 1 describes the current state of affairs for engineer-managers in the U.S. and the management challenges that lie ahead of them. It also presents the scope, objectives, and methodology of the report.

Chapter 2 contains an overview of the literature search and the procedure used to select the management elements most important to the engineer-manager.

Chapter 3 explains how the questions, analysis, and improvement checklist that make up EMERITUS were developed.

Chapter 4 provides a step by step procedure for engineer-managers to follow if they intend to use EMERITUS to evaluate and improve their management performance.

EMERITUS will be tested on an engineer-manager and his or her workers. In addition, it will be reviewed by at least one senior engineer-manager. The outcome of the tests will be presented in Chapter 5 along with any modifications made to EMERITUS as a result.

The lessons learned by the writer and the conclusions that were reached as a result of this research will be presented in Chapter 6. Recommendations for future research in this area will also be addressed.

Appendix A contains definitions of the seven key management elements selected by the writer. Appendix B

contains questions intended to indicate the performance and capabilities of the engineer-manager in the key management elements. The solutions to the questions, along with a scoring system are contained in Appendix C.

The most important section of the report is Appendix D. It takes all the information contained in the references that pertain to the selected management elements and condenses it. What remains is only the most salient management methods and rules-of-thumb. Engineer-managers should be able to use the checklist to improve their management performance.

Appendix E is an addendum that the writer created after testing EMERITUS on an engineer-manager. By making these changes to Appendix B and Appendix C, the reader or user will have an updated tool that incorporates the lessons learned in developing this report.

CHAPTER 2

SELECTION OF MANAGEMENT ELEMENTS

2.1 Introduction

Management consists of a set of interrelated processes, which when integrated, result in the efficient and effective use of an organization's resources in its quest to meet its objectives.[13] Scholars and managers disagree about how to classify the management processes.[14] This report does not attempt to support or defend any particular breakdown of the field of management into management processes and elements. The wide variety of descriptions used by various authors in the field of management shows a lack of consensus. Consequently, this report draws management elements from numerous sources to help describe the functions of the engineer-manager.

2.2 Literature Search

A literature search was conducted. Numerous sources were investigated including:

- Textbooks on management and a selected list of other management books as recommended by several engineering management professors

- The past eight years of the Journal of Construction Engineering and Management
- The past eight years of the Project Management Journal
- The past three years of Fortune magazine
- The past three years of the Harvard Business Review
- Management books currently popular in bookstores
- Books and articles used in other course work
- References cited in bibliographies of the above sources

The above sources were reviewed for their applicability to the scope of the report. Those that seemed appropriate are listed in the bibliography. Every reference in the bibliography was reviewed specifically for the management processes and elements it contained. Many of the references were outlined to assist in analyzing them.

Examples of how the writer outlined the references are shown in Figures 2-1 to 2-7.

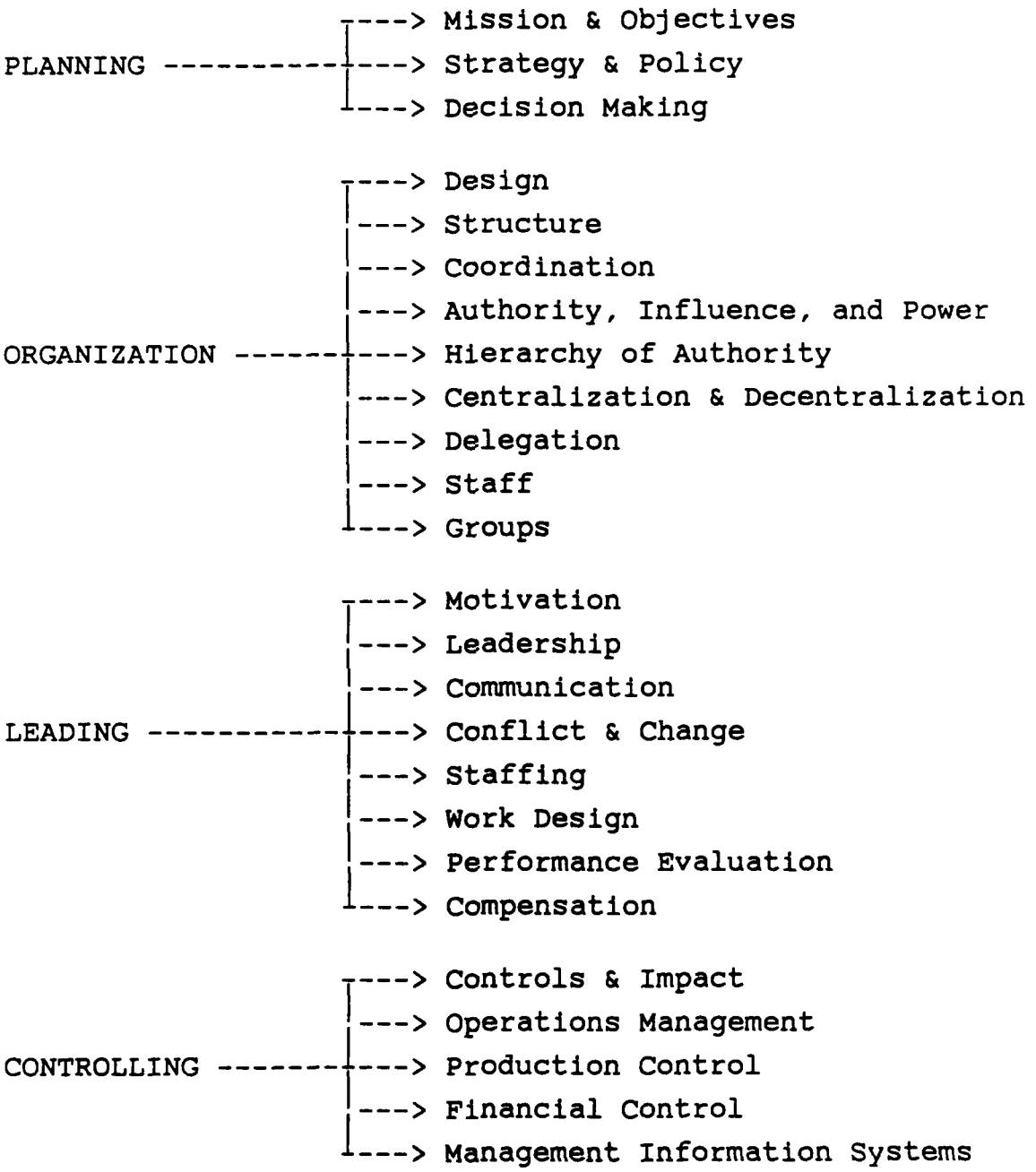

Figure 2-1

Outline of Managerial Functions in

Management by David R. Hampton[15]

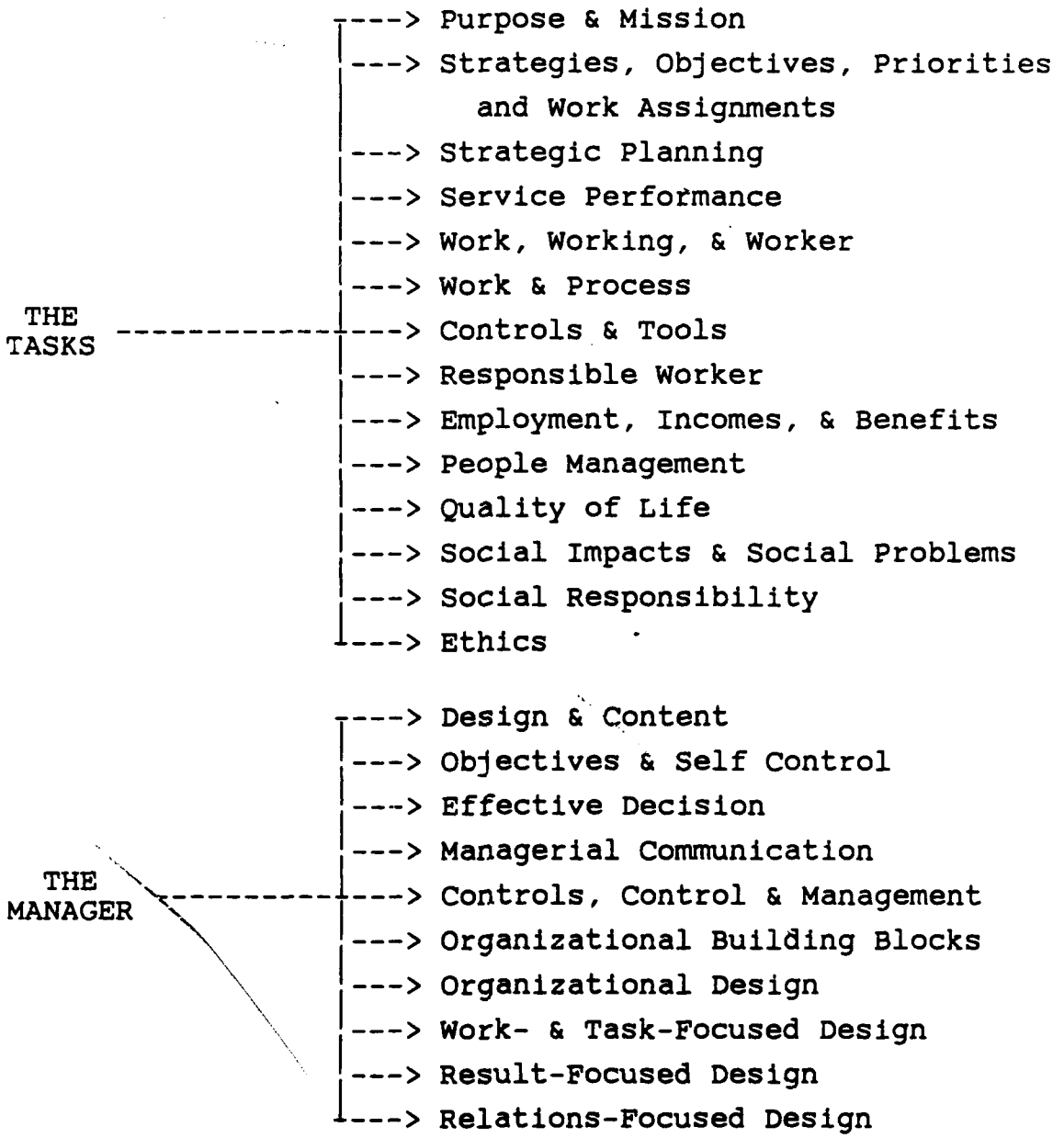

Figure 2-2

Outline of Management Functions in

Management by Peter F. Drucker[16]

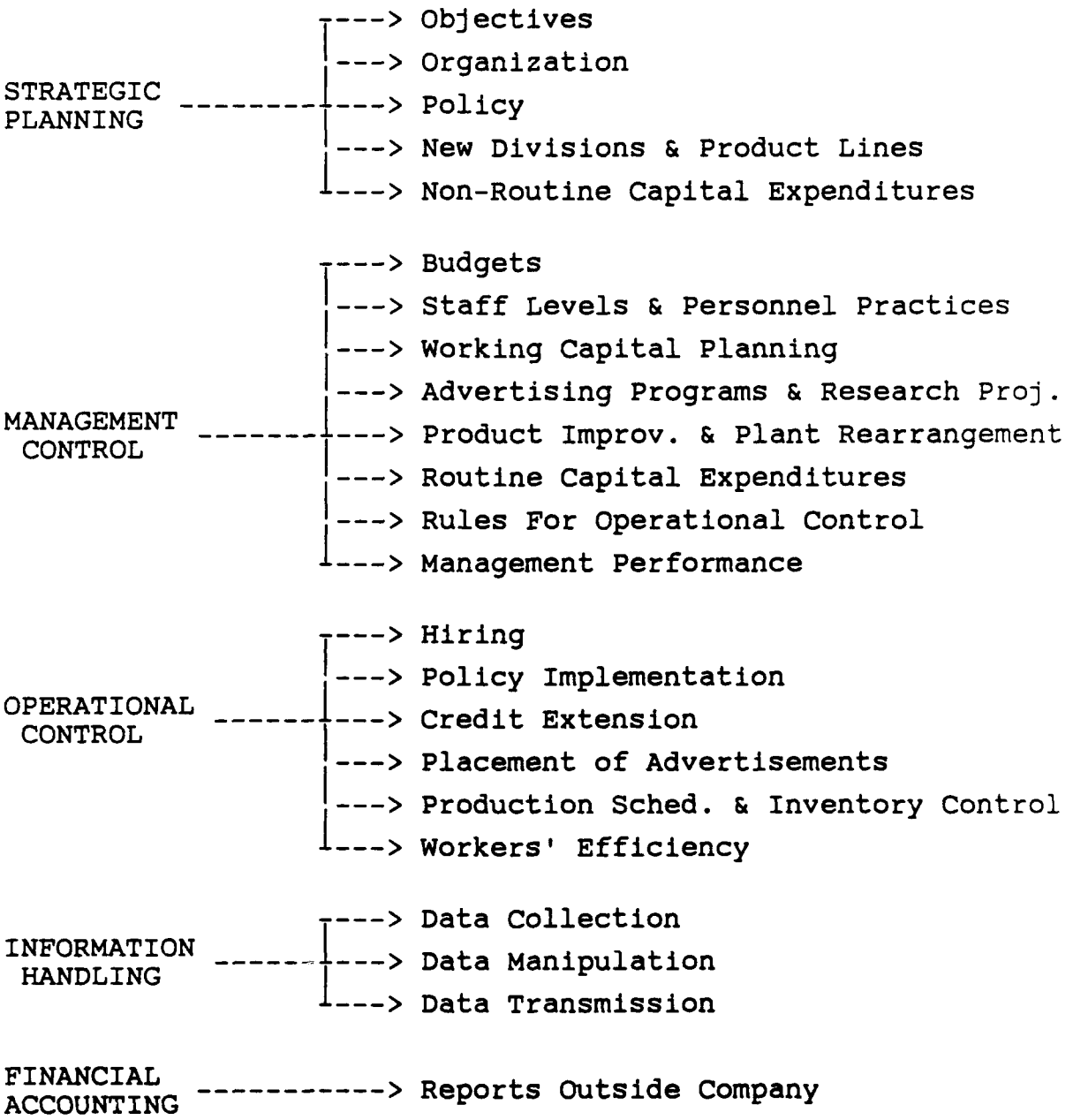

Figure 2-3

Outline of a Planning and Control System in

Planning and Control Systems by Robert Anthony[17]

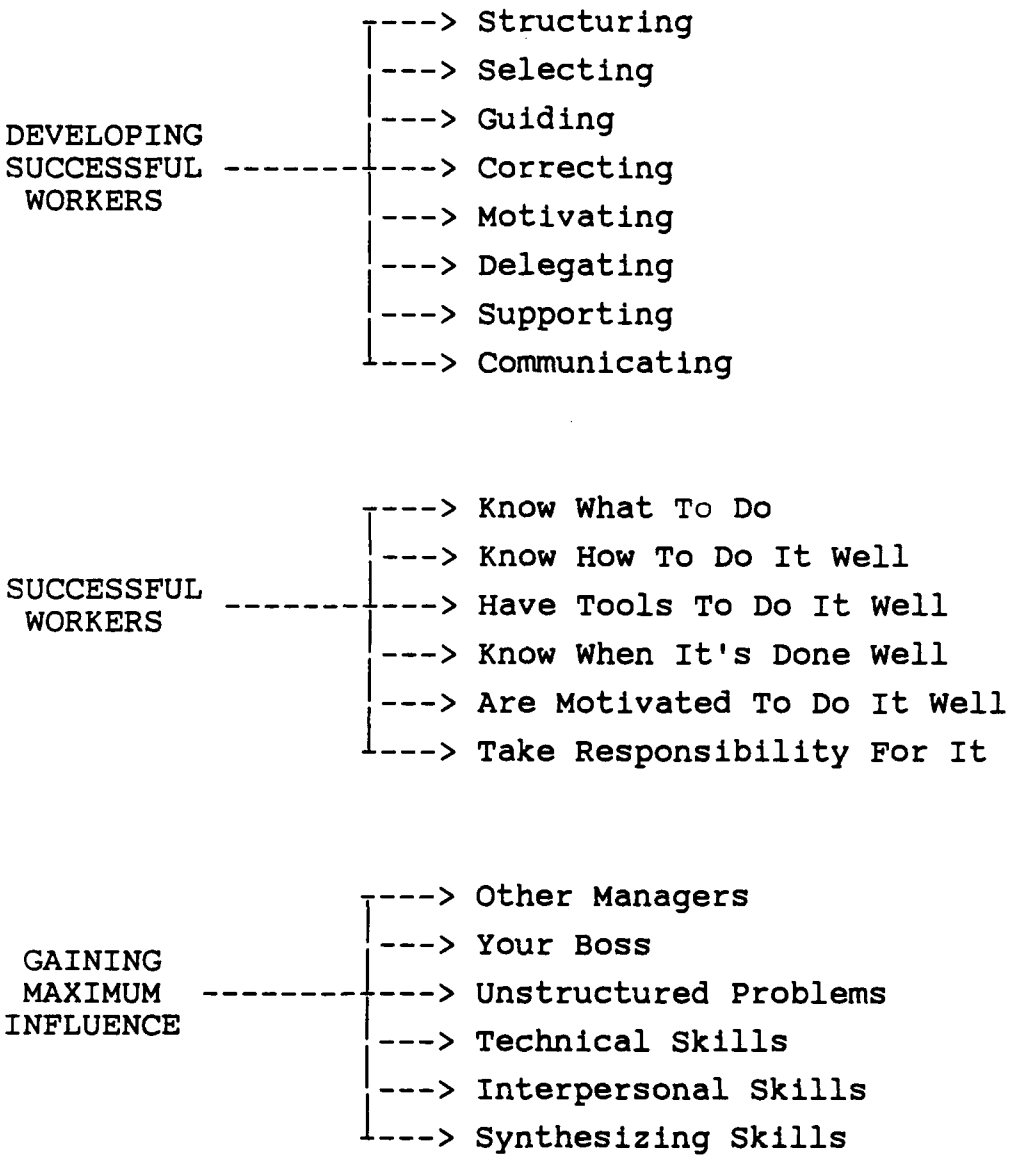

Figure 2-4

Outline of Managerial Functions in

The New Manager's Survival Manual by Clay Carr[18]

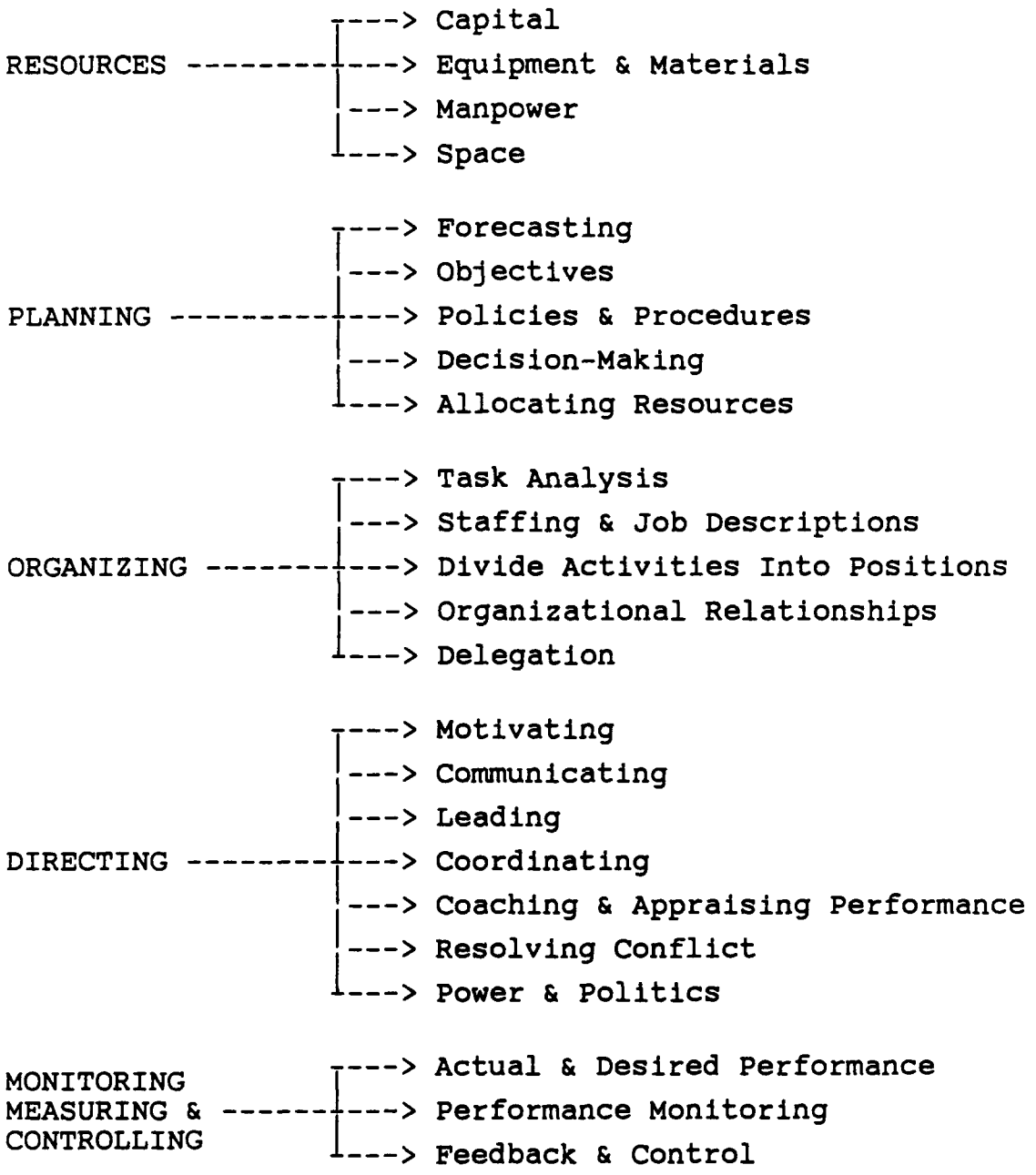

Figure 2-5

Outline of Managerial Functions in

Developing Managerial Skills in Engineers and Scientists

by M. K. Badawy[19]

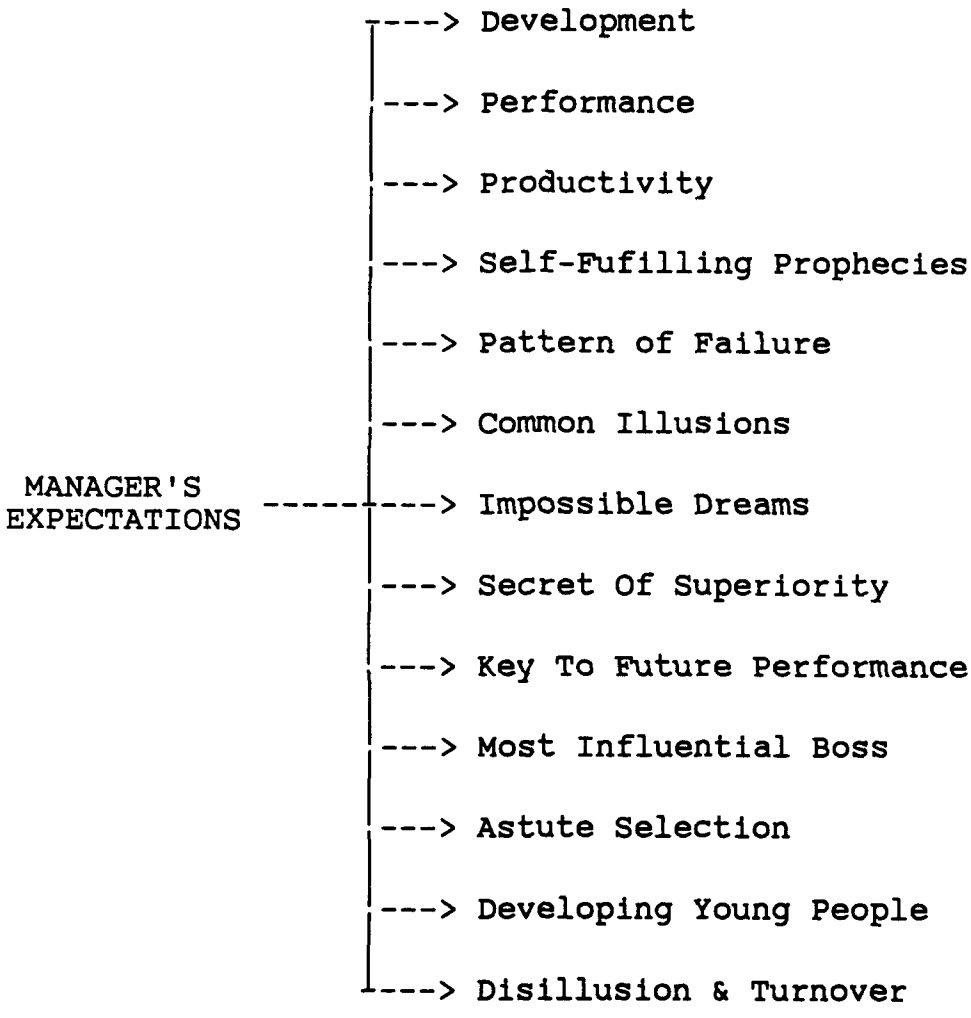

Figure 2-6

Outline of the Power of Managers' Expectations in "Pygmalion in Management" by J. Sterling Livingston[20]

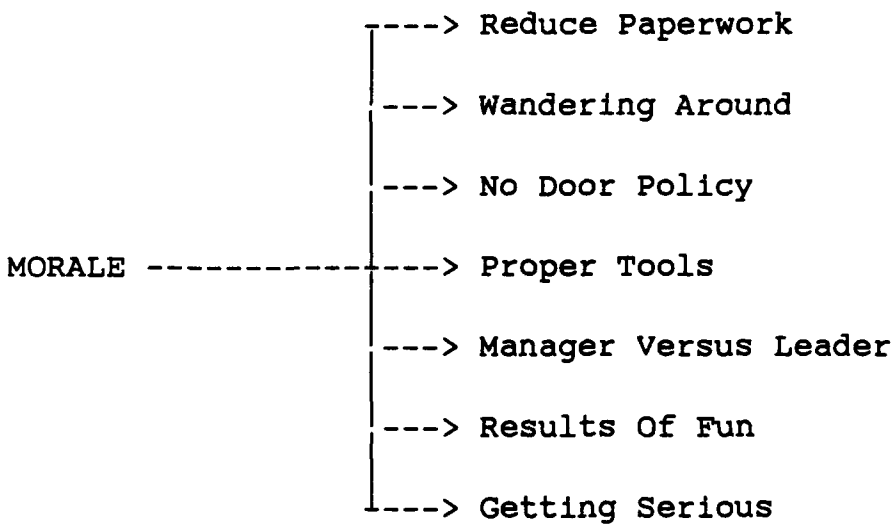

Figure 2-7

Outline of How to Create a Fun Work Environment in "FUN - The Forgotten Engineering Management Tool" by Robert F. Russell[21]

The figures depict the different types of information found in the various types of sources reviewed. Figure 2-1 outlines a management textbook, while Figure 2-2 and Figure 2-3 outline books on management by well known authors in the field of management. Figure 2-4 outlines a "how-to" book on management currently found in bookstores. Figure 2-5 outlines a book on management for engineers and scientists, while Figure 2-6 and Figure 2-7 outline journal articles on management.

2.3 Selection of Elements

The starting point for developing a comprehensive list of management processes and elements was the textbook, Management, by David Hampton. He divides management into four processes: planning, organizing, leading and controlling. As shown in Figure 2-1, each management process is broken into sub-processes or management elements. Figure 2-1 was used as a framework for combining and organizing the management elements extracted from all other references and their respective outlines. This was accomplished by reviewing all of the reference outlines from the literature search against the outline of Figure 2-1. Duplicative management processes and elements were discarded. New or different management elements were added. The majority of the outlines

reviewed contained similar management elements described by slightly different terminology. These elements were not included. The outcome of this process was a comprehensive list of management processes and elements.

2.4 Summary

Chapter 2 first gave a brief overview of the sources examined during the literature search. Examples of some of the outlines developed from individual management references reviewed were presented as Figures 2-1 through 2-7. The process of outlining the references helped the writer to extract each author's ideas of how to categorize the different management functions and skills. The writer then combined all the management elements from all of the individual outlines. Further editing deleted all synonymous management elements. This process produced a comprehensive list of management elements. Chapter 3 explains how this list of management elements was pared down to the key management elements which were used to develop EMERITUS.

CHAPTER 3

DEVELOPMENT OF EMERITUS

3.1 EMERITUS

EMERITUS stands for Engineer-Manager's Evaluation, Review, and Improvement Tool. EMERITUS was developed from the key management elements, as shown in Figure 3-1, as a tool to help engineer-managers evaluate, review, and improve their performance as managers. As shown in Figure 3-2, EMERITUS consists of four main parts. An explanation of each part is included in sections 3.2 to 3.5. The actual definitions of key management elements, questions, review and evaluation criteria, and improvement checklist are contained in Appendices A through D.

3.2 Key Management Elements for EMERITUS

Based on the writer's experience, the list of management elements was pared down to a size that could easily be grasped. However, the list still had to describe the most important attributes, as determined by the writer's experience, needed by the engineer-manager to succeed, see Appendix A, items A.1 to A.7. The writer decided that seven elements were sufficient. This number was chosen based upon the limitations on the amount of

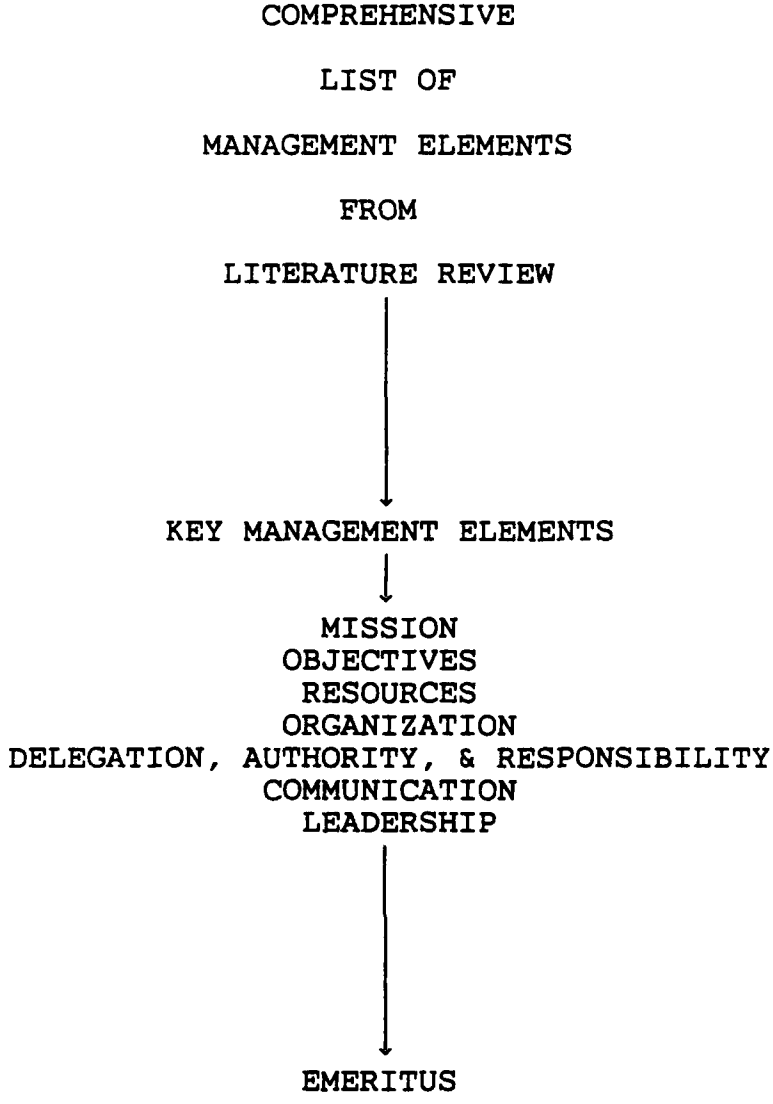

Figure 3-1

Development of EMERITUS

Figure 3-2

Components of EMERITUS

information that the average person is able to receive, process, and remember. Depending on the type of information and how it is presented, the number of pieces of information is usually around seven.[22] This is more commonly known as the rule of seven or seven plus or minus two.

Condensing the management elements to seven was accomplished in several steps. Some elements were considered to be subsets of others and were combined. Some elements were discarded as not pertinent to the engineer-manager described in the scope of work. The remaining elements were then prioritized by the writer from most to least important to the engineer-manager. The list of management elements was thus reduced to the seven key management elements shown in Figure 3-1. Definitions of each key element are contained in Appendix A.

One management process not included in the above list was CONTROL. The writer felt that the ability to control depended heavily on the seven key management elements. CONTROL was therefore ranked lower. The writer maintains that superior performance in the key management elements reduces and replaces the need for many controls.

3.3 Questions

A list of questions, Appendix B, derived from the key management elements was designed to determine whether or not an engineer-manager exhibits the traits and behavior normally associated with successful managers. Several questions related to each of the key management elements were developed to determine the level of competence that engineers exhibited in their work environment. Many engineers possess a great deal of knowledge in the area of management, but fail to use it in practice.

The references that discussed management elements in terms of actual behavior were used extensively to develop the questions. In addition, the writer used his experience both as a manager and as an observer of other managers to determine what types of behavior lead to positive or negative results. The combination of information from these two sources was used to develop questions that would determine what type of behavior a manager was exhibiting. General questions requiring only a yes or no answer were not used. Questions that asked the engineer-managers about a specific event were developed to help alleviate the possibility of engineer-managers conveniently forgetting their mistakes. Many of the engineer-manager's answers are verified by either the engineer-manager's workers or boss.

3.4 Review and Evaluation

This section allows engineer-managers to review and evaluate their responses against answers that are generally recognized as leading to positive results. Each answer is given a grade of -1, 0, or +1 to allow for an overall evaluation of the engineer-manager's performance, see Appendix C.

Again, the references that discussed management elements in terms of actual behavior and the writer's experience were used to develop the review and evaluation section. For each question, a range of responses was developed that spanned from highly desirable behavior to average behavior to undesirable behavior. The standards were set high on many of the questions. Other questions were considered to have only acceptable or unacceptable answers. A grading system was designed to give credit to engineer-managers who followed the principles of management proposed by the references and the writer that lead to success as a manager. This will allow the engineer-managers to evaluate their overall performance.

3.5 Improvement Checklist

The most important and useful part of EMERITUS is the improvement checklist, see Appendix D. This improvement checklist lists actions or techniques that engineer-managers

can use to improve their performance for each key management element. The checklist was developed using all information at the writer's disposal. Each reference was reviewed for information pertaining to each key management element. The most applicable ideas, methods, and techniques to the engineer-manager described in the scope of work were extracted. The information was then distilled to a manageable amount based on the writer's experience. The improvement checklist is a synopsis of what engineer-managers must do to improve their performance.

The writer believes that by following the techniques and rules-of-thumb in Appendix D, engineer-managers will be able to improve their performance. This checklist will not, however, help the hopelessly incompetent managers. The seven key management elements addressed cover a wide area in the field of management that must be blended together in a mix suitable for each engineer-manager. The assistance offered by Appendix D only begins to scratch the surface of the knowledge needed to perform as a manager. In addition, depending on the scope of the engineer-manager's job, there are other elements of management that must be used to properly carry out their duties.

The writer thinks that engineer-managers who review and incorporate this information into their job will get a head start in the right direction. Ultimately, it is up to the

individual to read management related literature, take management courses, experiment with a work group, and observe other managers to really become a good manager. And finally it also takes experience, which can't be rushed or taught.

3.6 Summary

Chapter 3 first explained how the writer chose the seven management elements used in EMERITUS. The writer then described the process used to develop the question, review and evaluation, and improvement checklist sections of EMERITUS.

CHAPTER 4

USER'S GUIDE

4.1 Introduction

As mentioned in Chapter 3, EMERITUS consists of four components. They are included as Appendix A to D. Appendix A defines the seven key management elements. Appendix B contains questions for engineer-managers, their workers, and their bosses. Appendix C evaluates and scores the answers to the questions. Appendix D is a checklist of ideas which should help engineer-managers improve their performance.

The numbering system for Appendix A, B, C and D are the same. The definitions, questions, scoring criteria, and checklist for a particular management element such as "Objectives" are contained in section A.2, B.2, C.2, and D.2, respectively. To make best use of this tool the engineer-manager should use the following procedure:

4.2 Preparation

- Ask someone to assist you in evaluating your management performance.

- Make enough copies of Appendix B to give your workers, yourself, your boss, and your assistant a copy.
- Make a copy of Appendix C for your assistant.
- Let your assistant read this chapter and skim through Appendix A, B, and C.
- Get everyone to answer the questions at the same time.

4.3 Testing Procedure

- Have your assistant gather all your workers in a meeting room. You should not be in or near the meeting room, so as not to intimidate any of your workers from giving candid answers.
- Have your boss answer the questions whenever he or she feels like it.
- Have your assistant explain to your workers that the purpose of the questionnaire is to evaluate your management performance. Honest answers are essential. Assure your workers that they will not get into trouble if they answer candidly. Your assistant will compile the results, give the results to you, and that is where it will stop. Stress these points.

- Have your workers answer all questions with a "W" below the number. You should answer all questions with a "EM" and your boss should answer all questions with a "B."
- Have each person taking the test write their name on it. Your assistant will need to correlate some of your answers with the worker's answers.
- Have your assistant go through each question with your workers. He or she should read the question from Appendix B and then look at the grading criteria in Appendix C. Let the workers answer the question. If there are any questions from the workers about how to answer the question, the assistant should be able to provide guidance by reviewing Appendix C without biasing the worker's answers.
- Be sure that all answers are in a format that coincide with the grading criteria.
- Tell the workers to give the answer that first comes to mind and if they don't fully understand a question to ask the assistant. If that does not help then guess.
- Answer "not applicable" for any questions that do not apply.

4.4 Analysis

- A +1 on any question means that you seem to be "on top of" that particular area.
- A 0 on any question means that you seem to be about average in that particular area.
- A -1 on any question means that you seem to be need work in that particular area.
- An overall score on any element above + 2 means you appear to be on top of that area of management.
- An overall score on any element between + 2 and - 2 means you appear to be about average in that area of management.
- An overall score on any element below - 2 means you appear to need more work in that area of management.
- An overall score on the entire test above + 7 means you appear to be an above average manager.
- An overall score on the entire test between + 7 and - 7 means you appear to be about average as a manager.
- An overall score on the entire test below - 7 means you appear to need more work to be a successful manager.

- If all questions are applicable, the highest possible score is +65. The lowest possible score is -66.

4.5 Interpretation of Results

This tool is only an order of magnitude indicator of your knowledge of your work group, your workers, your resources, and your basic management skills. The important factor is how these skills and knowledge fit together and how your personal style delivers your message to your workers. Appendix D will provide specific guidance on how to improve those areas that were indicated to be a weakness.

4.6 Summary

Chapter 4 provided engineer-managers with a step by step procedure to use if they intend to use EMERITUS. A pre-test preparation section and testing procedure section gave the engineer-manager the information needed to conduct the test quickly and effectively. The analysis and interpretation of results section gave the engineer-manager helpful guidance to objectively review and evaluate test results.

CHAPTER 5

EVALUATION OF EMERITUS

5.1 Scoring and Critique

EMERITUS contains a total of 60 questions. The engineer-manager was required to answer 59 questions. The workers were required to answer 25 questions. The boss was required to answer 11 questions. The highest possible score was +65. The lowest possible score was -66.

Following the user's guide, EMERITUS was tested on an engineer-manager and three of his workers. The engineer-manager was the head of a 15 member research group. Although not atypical, the organization and situation was not the intended target audience of EMERITUS. The engineer-manager taking the test achieved a score of +20. After taking the test, the engineer-manager was debriefed on his performance and his comments on each question were obtained. The worker's evaluation of individual questions and the overall test were also obtained. The following paragraphs summarize the results of the test by key management elements:

5.1.1 Mission

There were four questions in this section. The highest possible score was a +5. This engineer-manager obtained a score of +3. All questions were understood and answered in the manner in which the writer intended. The answers were easily correlated and scored. The engineer-manager thought that all questions elicited pertinent information. The score of +3 accurately portrays this engineer-manager's actual performance in this area.

5.1.2 Objectives

There were seven questions in this section. The highest possible score was +8. This engineer-manager obtained a score of +2. The engineer-manager and the workers had different interpretations of what the objectives of the work group were, question B.2.1. A more through explanation of the word, "Objective," is necessary. The engineer-manager received -1 on questions B.2.1-B and B.2.3 which discussed the role of his boss's objectives as they relate to him. After discussing the situation, it became apparent that the questions failed to take into the account the possibility of failure on the boss's part to take a more active interest in setting and monitoring the objectives of his subordinates. As such

the questions need to be reworded to reflect only the performance of the engineer-manager and not his boss.

The remainder of the questions obtained evidence that the engineer-manager and his workers knew their objectives, their objectives were measurable, and their objectives were reviewed periodically. The engineer-manager's score should have been slightly higher to adequately reflect his actual performance in this management area.

5.1.3 Resources

There were six questions in this section. The highest possible score was +7. This engineer-manager obtained a score of +5. The solutions to questions B.3.4 and B.3.5 need to be reworded to allow some flexibility in answers. Question B.3.4 requires an exact answer when an approximate answer would still indicate a high level of proficiency. Question B.3.5 requires the engineer-manager to produce a list of physical spaces he is responsible for maintaining. This is a good idea but not really necessary if he is only responsible for 2 or 3 spaces. The remainder of the questions obtained adequate evidence of the engineer-managers performance in order to score him. These questions and score accurately portray this engineer-manager's actual performance in this area.

5.1.4 Organization

There were three questions in this section. The highest possible score was +4. This engineer-manager obtained a score of -1. This was a low score and the engineer-manager thought the score was appropriate. He did not feel that an organization chart was necessary for his organization, question A.4.1, but that in most situations it would be. Question A.4.3 accurately pointed out that his span of control was too great and that he was having problems with it. Overall this section was able to obtain enough evidence of the engineer-manager's actual performance to accurately score his performance.

5.1.5 Delegation, Authority & Responsibility

There were twelve questions in this section. The highest possible score was +11. This engineer-manager obtained a score of +3. Questions B.5.1, B.5.2, and B.5.3 were good questions that pointed out the strengths and weaknesses of this engineer-manager's work group and the problems associated with managing a research group. The solution to question B.5.4 needs some flexibility for engineer-managers that draft all their own letters. The solutions for questions B.5.5 and B.5.11 do not differentiate between those engineer-managers that have been assigned too much work by their bosses as opposed to

those engineer-managers who try to do all of their worker's work.

Question B.5.8 was too vague as was the writer's original purpose behind the question. It should be deleted. The engineer-manager felt that question B.5.12 pointed out a particular weakness of his in that he does not keep track of what he delegates. The remainder of the questions adequately obtained useful documentation of the engineer-manager's track record in this area. His score accurately portrayed his level of performance.

5.1.6 Communication

There were eight questions in this section. The highest possible score was +10. This engineer-manager obtained a score of 0.

The engineer-manager took exception to the writer's reasoning behind what constituted a good answer to questions B.6.2 and B.6.3. Both questions addressed the accessibility of the engineer-manager to his workers. He convincingly argued that being too accessible invited the workers to bring problems to him that they should be solving themselves. The writer suggests that if the engineer-manager sent the workers back to solve their own problems they might eventually learn that accessibility does not mean "bring all your problems to me for a

solution". There is obviously room for debate on this question.

Question B.6.4 does not take into account the reasons behind wny the boss has not questioned the engineer-manager. It should be deleted. Questions B.6.5, B.6.6, B.6.7, and B.6.8 all were good questions that sought to determine how well the work group knew what their customers wanted from them. The engineer-manager agreed with this but also pointed out some of the problems in making this work in practice in a research group. Overall the engineer-manager's score on this section accurately reflected his actual level of performance.

5.1.7 Leadership

There were twenty questions in this section. The highest possible score was +20. This engineer-manager obtained a score of +7. The engineer-manager felt that the ideas behind questions B.7.1 and B.7.5 were good but that they did not elicit the evidence necessary to make an accurate assessment of his performance. The questions need to be reworded. He felt that question B.7.3 and the reason for the question was excellent and that this was an area where he needed more work. Question B.7.4 should be deleted. The information obtained does not measure the engineer-manager's leadership performance. Question

B.7.10 should be reworded to accurately determine why a worker is staying home from work.

The engineer-manager felt that questions B.7.12 and B.7.13 were two of the better questions in EMERITUS. They delve into the important area of perception of performance and potential between workers and the engineer-manager. Although the engineer-manager received a +1 on both questions, after looking at the worker's answers he could see that he still had a problem.

Questions B.7.14, B.7.16, and B.7.20 should be deleted, unless the wording can be drastically improved to derive the evidence necessary to accurately score it. In their present form they are too vague. The engineer-manager felt that the scoring criteria for question B.7.15 was incorrect. He felt that too much praise diluted the meaning behind recognizing a worker's good performance. The question should be reworded. The scoring criteria for question B.7.17 needs to be revised to include guidelines for those engineer-managers who do not give letters recognizing good performance. The engineer-manager felt that question B.7.18 rewarded trying to gain favor with your boss. The question should be deleted. This score accurately reflected the engineer-manager's level of performance in this area.

5.2 General Problems and Observations

The questions that elicited the most useful information were the shorter, very specific questions that in some way limited the scope of the responses. The key management elements that had only a few questions seemed to be the ones that most accurately depicted the engineer-manager's performance.

It was sometimes hard to determine why the engineer-manager performed well on a question. Was it because he knew what he was doing, or did the question just happen to hit on an aspect of his job that was particularly easy for him to deal with? Conversely, why did the engineer-manager perform poorly on a question. Was it because he did not know what he was doing, or did the question just happen to hit on an aspect of his job that was more difficult than the average job? Similarly, it was also hard to determine whether some questions were just bad questions or if the engineer-manager's performance was truly below average.

Some workers did not fully understand some of the terms used and were unsure of who the questions addressed. As such, they answered some of the questions from the wrong point of view. Numerous questions were too vague or too objective to obtain useful information from, as indicated in section 5.1. On a few questions some of

the workers were unable to come up with any answer.

All the questions in EMERITUS were weighted equally, yet some were obviously more important than others. This will be a difficult problem to rectify.

In giving the tests to the workers, minimal explanation of the questions were given and there was little discussion so as not to bias any of their answers. It might have been more beneficial to give the test individually with more explanation of the questions to obtain a higher quality and more useful response, hopefully without biasing the answers.

5.3 Recommended Adjustments to EMERITUS

Based on the results and lessons learned from the test, the writer recommends making the following adjustments to EMERITUS:

5.3.1 Delete or reword the questions indicated in section 5.1.

5.3.2 Define the seven key management elements and several other words that caused confusion among the test subjects to the test subjects prior to answering the questions.

5.3.3 Give examples of the types of answers you are looking for without directing the answer being given.

5.3.4 Instead of one consolidated list of questions that can be given to the engineer-manager, workers, and boss, separate questions must be developed. All the questions now are worded from the engineer-manager's point of view. This caused a great deal of confusion with the workers and in some cases resulted in erroneous information being given. Each group needs a separate questionnaire written from their perspective.

5.3.5 The person administering the test must be familiar with the engineer-manager's field of work and organization. The interpretations required to correlate the worker's, boss's and engineer-manager's questions would be impossible without this knowledge.

5.3.6 Disregard the significance of the score for any given question or management element. The questions are too objective and there are too few questions for each key element for this to be used as an accurate indicator of performance over that narrow an area. Rather the overall score is an accurate indicator.

5.3.7 The user's guide states that an overall score between -7 and +7 denotes above average

performance. This writer feels that an overall score between 0 and +15 is above average.

5.3.8 Do not overemphasize the importance of the overall score obtained from EMERITUS. EMERITUS is a tool to get engineer-managers to focus their attention on the areas in which they need to improve their management performance. It is not an exact indicator of managerial talent. A perfect score on this test does not mean you are a great or even a good manager. What it means is that you seem to have a firm grasp on many of the fundamental aspects necessary to be a good manager. Likewise, a low score does not mean that you are a failure as a manager. Managerial performance depends on much more than the key elements listed in EMERITUS.

5.4 Overall Evaluation

The engineer-manager who took this test achieved a score of +20 out of a possible range of -66 to +65. According to the user's guide this is an above average score. Overall this engineer-manager appears to put in practice many of management skills necessary to achieve superior performance as a manager. His score appears to be an accurate assessment of his actual performance.

Whatever his score, this engineer-manager would learn from using EMERITUS. Reviewing the results of the questionnaire and the Improvement Checklist in Appendix D should help him to further improve his performance. The Improvement Checklist was not evaluated in this test.

The Improvement Checklist in Appendix D is the most important part of EMERITUS. An engineer-manager can use the Checklist by itself if he or she does not have the time or the inclination to use the questionnaire. Just reading and thinking about some of the points made in the Improvement Checklist should benefit either the novice or experienced engineer-manager.

5.5 Changes Incorporated in Addendum

The recommendations made in sections 5.1.1 through 5.1.7 have been incorporated into an addendum, Appendix E. Making the suggested changes to Appendix B and Appendix C gives the reader a set of questions and review and evaluation criteria that reflect the lessons learned by this writer.

5.6 Summary

Chapter 5 first summarizes the results of the test given to an engineer-manager. The good and bad questions for each management element are highlighted. General

observations by the writer along with recommended adjustments to EMERITUS are presented. The chapter concludes with an objective evaluation of the management performance of the engineer-manager that took the test.

CHAPTER 6

CONCLUSION

6.1 Overview

Today's engineer must operate in a constantly changing, global environment that is becoming ever more complex as new methods and technologies are developed. The time that both the undergraduate and practicing engineer must spend learning and keeping current with this technology is ever increasing. This is placing an ever bigger burden on the time available for the engineer to learn how to manage. Although managing comes naturally to some engineers, the vast majority of engineers must learn how to manage. The significance of the problem can not be underestimated given the state of this nation's economy and the growing competition from abroad.

Today's technology must not only be understood to be applied, it must be managed. There are so many more parties involved in any given project than in the past. This is due mainly to the increasing specialization of engineers as a result of the increasing complexity of the engineering field. The engineers who do not understand how to manage the resources at their disposal will soon find themselves without those resources.

6.2 Conclusion

The key management elements for the engineer were selected after a thorough literature search. Obviously the ranking of the key elements was objective on the writer's part. But, when choosing only the top seven management elements out of a much larger list, the truly important elements really stood out against the others.

The test of EMERITUS was very helpful in determining the strengths and weaknesses of the report. However, EMERITUS needs to go through several more iterations to really refine the questions and the scoring system.

Many engineers neglect delving into the subject of management because they don't know where to start or they are overwhelmed by the volume of information available and they only have a little time to devote to the task. Although a very crude tool, engineers pressed for time may find EMERITUS as a helpful first step in learning a little bit about what "management" encompasses, where they should initially focus their attention, and a few ideas about how to start improving their management performance.

6.3 Closure

Today's engineer has little time to devote to learning the art of management. This report has condensed some of the aspects of management most important to the

engineer into a report that can be quickly read and digested. Then if the engineer wishes to go further he or she can use EMERITUS to perform a crude evaluation of their own performance as an engineer-manager. If EMERITUS only gets engineers to think about their management performance, then it has done its job. The engineer who wishes to succeed in today's environment must also be a good manager. There is no way around it.

NOTES

[1] Ferd H. Mitchell, Jr., "A Management Model for Engineers," Proceedings American Society for Engineering Education 92nd Annual Conference, vol. III, (24-28 June 1984): 1214.

[2] Mitchell, 1214.

[3] National Science Foundation, U.S. Scientists and Engineers: 1986, NSF 87-322 (Washington: 1987): 45.

[4] National Science Foundation, Characteristics of Recent Science and Engineering Graduates: 1986, NSF 87-321 (Washington: 1987): 51.

[5] "Engineering Education 2001," Engineering Education 78, no. 2 (November 1987): 115.

[6] Henrique Koza and Philip J. Richter, "Development of Engineering Managers: An Alternate Approach," Proceedings First International Conference on Engineering Management, (22-24 September 1986): 212.

[7] Koza and Richter, 211.

[8] Mitchell, 1214.

[9] Kerry Welker and Henry A. Wiebe, "The Role of Education in United States vs. Pacific Rim Competition," Proceedings American Society for Engineering Education Annual Conference, vol. 5, (19-23 June 1988): 1985

[10] Arnold S. Judson, "The Awkward Truth About Productivity," Harvard Business Review, (September-October 1982): 93-97.

[11] Mitchell, 1214.

[12] Welker and Wiebe, 1985.

[13] Harold Koontz and Cyril O'Donnell, Principles of Management: An Analysis of Managerial Functions (New York: McGraw Hill Book Company, 1972): 46-47.

[14] Koontz and O'Donnell, 46.

[15] David R. Hampton, Management (New York: McGraw Hill Book Company, 1986): 4-739.

[16] Peter F. Drucker, Management (New York: Harper & Row, 1985): 1-803.

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[19] M. K. Badaway, Developing Managerial Skills in Engineers and Scientists (New York: Van Nostrand Reinhold Company, 1982): 126.

[20] J. Sterling Livingston, "Pygmalion in Management," Harvard Business Review, (September-October 1988): 121-130.

[21] Robert F. Russell, "FUN - The Forgotten Engineering Management Tool," 1988 IEEE Engineering Management Conference, from AI to JZ, (24-26 October 1988): 116-119.

[22] George A. Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," The Psychological Review, vol. 63, no. 2 (March 1956): 81.

[23] Drucker, 75.

[24] Hampton, 505.

[25] Hampton, 22.

[26] Robert W. Keidel, Corporate Players (New York: John Wiley & Sons, 1988): 104.

[27] Keidel, 104-105.

[28] Keidel, 108.

[29] Drucker, 74-94.

[30] Drucker, 102.

[31] Peter F. Drucker, The Practice of Management (New York: Harper & Row, Publishers, Inc., 1954): 194-201.

[32] Koontz and O'Donnell, 246.

[33] Hampton, 334.

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APPENDIX A

KEY MANAGEMENT ELEMENTS FOR EMERITUS

A.1 Mission

The mission or purpose of an organization is it's main transcending reason for existence. It includes the function the organization performs for society and the basic character and philosophy of the organization.[23]

A.2 Objectives

Objectives specify the end results that an organization seeks to achieve by carrying out its mission. An organization's mission should always guide the setting of objectives. The mission of an organization must be translated into objectives, otherwise the mission is nothing more than words on paper. Objectives must be translatable into definitive targets and explicit assignments.

A.3 Resources

Resources are the capital, equipment, manpower, materials, space, and time that engineer-managers employ to achieve the objectives of their organization.

A.4 Organization

An organization is an entity that is divided into units and sub-units. Each unit and sub-unit has authority, responsibility, and accountability requirements to another unit or sub-unit for achieving some part of the objectives of the organization.

The design and structure of an organization is the arrangement and configuration of it's workers and resources. The first step in designing an organization is identifying and organizing the components and activities. However, structure is the means by which an organization achieves it's objectives. Therefore, the objectives of an organization must be determined before deciding on how to structure it.

A.5 Delegation, Authority, & Responsibility

Delegation, Authority, & Responsibility are all interrelated. Delegation is the process by which managers assign to subordinates various tasks and the authority and responsibility to complete them. Authority is the right to direct and commit personnel and resources to complete assignments and objectives. Responsibility is accountability for the successful completion of assignments and objectives.

A.6 Communication

There are two interrelated kinds of communication: effective and good.

o Good communication occurs when the receiver's understanding matches the meaning intended by the sender.

o Effective communication occurs when the sender obtains the desired results from the receiver.

Therefore, you can have good communications (understanding) without effective communications (achieving intended results). This occurs when the receiver understands the communication, but for some reason chooses to ignore it. Obtaining understanding when communicating is only a first step. The real challenge is obtaining the desired results.[24]

A.7 Leadership

Leadership can be defined in two ways. The first refers to the broad range of activities by which managers establish the character and tone of their organization. These activities include articulating and exemplifying the distinctive values and style of an organization. The second meaning of leadership refers to the interpersonal influence process through which managers communicate with subordinates about the accomplishment of work.[25]

APPENDIX B

QUESTIONS

B.1 Mission

B.1.1 What is the mission of your work group?

W/EM/B _____

_____

_____

B.1.2 Take out a copy of your work group's mission statement.

EM _____

B.1.3 What is the mission of your boss's organization?

EM/B _____

_____

_____

B.1.4 Take out a copy of the mission statement for your boss's organization.

EM _____

B.2 Objectives

B.2.1 What are the objectives of your work group?

W/EM/B _____

_____

_____

_____

B.2.2 Take out a copy of your work group's objectives.

EM _____

B.2.3 What are the objectives of your boss's organization?

EM/B _____

_____

_____

_____

B.2.4 Take out a copy of your boss's organizational objectives.

EM _____

B.2.5 Take out a copy of the individual objectives for each member of your work group.

EM _____

B.2.6 Look at the individual objectives for three or more of your workers. Where do you get the information from to measure the worker's progress towards each objective?

EM _____

B.2.7 Write down all the periodic reports that your work group processes. What percentage of the reports relate directly to one of the objectives of your work group?

EM _____

B.3 Resources

B.3.1 Take out a copy of your work group's budget.

EM _____

B.3.2 Take out a list or a set of custody cards that identifies expensive or critical pieces of equipment you are responsible for.

EM _____

B.3.3 Take out a roster or a set of personnel folders that identifies all the workers that are presently assigned to your work group.

EM _____

B.3.4 How many workers are you allowed according to your organization's guidelines?

EM/B _____

B.3.5 List or take out an inventory of the physical spaces you are responsible for.

EM _____

_____

_____

_____

B.3.6 What tools, equipment, supplies or information do each of your workers need to do their job well.

W/EM/B _____

_____

_____

_____

_____

B.4 Organization

B.4.1 Where is your work group's organization chart posted?

EM _____

B.4.2 Who provides each of your workers with the direction, information, equipment, tools or supplies they need to perform their job?

W/EM _____

B.4.3 How many people report directly to you?

W/EM _____

B.5 Delegation, Authority & Responsibility

B.5.1 Think of the last three tasks you delegated. What was the specific time target on each of them?

EM _____

B.5.2 When, approximately, was the last time one of your workers missed a due date for completing a task without asking for an extension?

EM _____

B.5.3 When, approximately, was the last time one of your workers completed a task for you that did not meet the intent of your delegation?

EM _____

B.5.4 Think of the last letter or report drafted for you by one of your workers. What did you do with it?

EM _____

_____

_____

B.5.5 Think of the last time you performed more than one hour of work outside of regular working hours. What were you working on?

EM _____

_____

_____

B.5.6 Find a copy of the last three letters or reports produced by your workers that were sent out of the office. Do they show who prepared them?

EM _____

B.5.7 Ask the worker who answers the office telephone to think of the last three people who called with a general problem or question. To whom were the calls referred?

EM _____

_____

B.5.8 Think of the last delegation you made to one of your workers where they stayed within the guidelines you set but the results were not what you expected or wanted. What did you do?

EM _____

_____

B.5.9 Think of the last worker who came to you with a work related problem. Who solved the problem?

EM _____

B.5.10 Go through every piece of paper on or in your desk that requires some action. What percentage of the papers have you read more than once without delegating the item or requesting the information you need?

EM _____

B.5.11 How many Saturdays or Sundays out of the last four weekends have you come in to work?

EM _____

B.5.12 Take out a list of items you have delegated.

EM _____

_____

B.6 Communication

B.6.1 Think of the last item of good news and the last item of bad news that you received that affected your work group. What was the news and how soon after you received the news did you tell your work group about it?

EM _____

_____

_____

B.6.2 Think of the last three days. How many hours of the work day, on average, was the door to your office physically closed?

EM _____

B.6.3 Think of the last three days. How many times have you wandered through your work spaces giving your workers the opportunity to talk to you? This is as opposed to passing through quickly, looking busy.

W/EM _____

B.6.4 How many times in the last week has your boss questioned you on your work group's progress or problems?

EM/B _____

B.6.5 List the customers that use what your work group produces.

W/EM/B _____

_____

_____

B.6.6 When was the last time each of your workers met one of your customers? List your workers, the customer, and the approximate date.

W/EM _____

_____

_____

_____

B.6.7 What do your customers do with the output you produce for them?

W/EM/B _____

_____

_____

_____

B.6.8 List one instance for each of your workers, that occurred within the last three months, where they received direct feedback, (letter, phone call, meeting), from a customer on work they completed for that customer?

W/EM _____

_____

_____

_____

_____

B.7 Leadership

B.7.1 When was the last time you admitted to your work group that you made a mistake? What was it?

W/EM _____

_____

B.7.2 Think of the last four weeks. Which workers in your work group have you raised your voice to in anger?

W/EM _____

B.7.3 What are the first and last names of each of your workers, their spouses, and their children?

W/EM _____

_____

_____

_____

B.7.4 List the workers in your work group whose jobs you could temporarily accomplish at a minimum level of performance?

W/EM _____

_____

B.7.5 Think of the last time there was a conflict of interest in your job. What was it and what did you do?

EM _____

_____

B.7.6 Who was the last worker you chastised for poor performance. Where did you do it?

W/EM _____

B.7.7 Who was the last worker you corrected for making a mistake. How soon after you found out about the problem did you correct them?

W/EM _____

B.7.8 Generally, do you enjoy coming to work each morning?

W/EM _____

B.7.9 In the past two weeks how many times were you late for work?

W/EM _____

B.7.10 How many total days have you been out sick in the past three months?

W/EM _____

B.7.11 Do you allow your workers to question your decisions?

W/EM _____

B.7.12 What do you believe the chances are of each of your workers succeeding in their present job and advancing to the next level? (rate each worker on a scale of 1 to 10, with 1 - no chance, 10 - no problem)

EM _____

_____

_____

B.7.13 (FOR WORKERS ONLY) What do you think, your boss (the engineer-manager), thinks about your chances of succeeding in your present job, and your chances for advancement? (rate yourself on a scale of 1 to 10, with 1 - no chance, 10 - no problem)

W _____

B.7.14 What motivates each of your workers to do a good job?

W/EM _____

_____

_____

_____

_____

_____

B.7.15 When was the last time that you recognized each of your workers for good performance? (this includes a verbal "good job").

W/EM _____

_____

_____

B.7.16 Name a non-performing or marginal worker. What have you done in the past week to make this non-performing worker uncomfortable about his or her performance?

EM _____

_____

B.7.17 The last time you recognized someone in writing for their superior performance, how long was it between the time of the superior performance and the time the worker received the recognition?

W/EM _____

B.7.18 Think of the last time you pointed out one of your worker's accomplishments to your boss. What and when was it?

EM/B _____

B.7.19 Think of the last time your boss instructed one of your workers to perform some task without first informing you. What did you do when you found out?

EM/B _____

_____

B.7.20 What was the last task one of your workers botched up while trying to do a good job. What did you do?

W/EM _____

_____

APPENDIX C

REVIEW AND EVALUATION CRITERIA

C.1 Mission

C.1.1-W	If 100% of your workers answers were substantially the same as yours	+1
	If ≥ 75% of your workers answers were substantially the same as yours	0
	All other answers	-1
C.1.1-B	If your boss's answer was substantially the same as yours	+1
	All other answers	-1
C.1.2	If you found a copy of the mission statement	+1
	All other answers	-1
C.1.3	If your boss's answer was substantially the same as yours	+1
	All other answers	-1
C.1.4	If you found a copy of the mission statement	+1
	All other answers	-1

C.2 Objectives

C.2.1-W	If 100% of your workers answers were substantially the same as yours	+1
	If $\geq$ 75% of your workers answers were substantially the same as yours	0
	All other answers	-1
C.2.1-B	If your boss's answer was substantially the same as yours	+1
	All other answers	-1
C.2.2	If you found a copy of your objectives	+1
	All other answers	-1
C.2.3	If your boss's answer was substantially the same as yours	+1
	All other answers	-1
C.2.4	If you found a copy of the objectives	+1
	All other answers	-1
C.2.5	If you found a copy of the objectives	+1
	All other answers	-1

C.2.6	If you listed an easily obtainable source of information for 100% of the objectives	+1
	If you listed an easily obtainable source of information for $\geq$ 75% of the objectives	0
	All other answers	-1
C.2.7	If = 100% relate directly to objectives	+1
	If $\geq$ 75% relate directly to objectives	0
	If $\leq$ 75% relate directly to objectives	-1

C.3 Resources

C.3.1	If you found a copy of your budget	+1
	All other answers	-1
C.3.2	If you found a list or set of custody cards	+1
	All other answers	-1
C.3.3	If you found a roster or set of folders	+1
	All other answers	-1
C.3.4	If your boss's answer was the same as yours	+1
	All other answers	-1

C.3.5	If you found a list or an inventory	+1
	All other answers	-1
C.3.6-W	If 100% of your workers answers were substantially the same as yours	+1
	If $\geq$ 75% of your workers answers were substantially the same as yours	0
	All other answers	-1
C.3.6-B	If your boss's answer was substantially the same as yours	+1
	All other answers	-1

C.4 Organization

C.4.1	If it is posted in a common work area	+1
	All other answers	-1
C.4.2	If 100% of your workers answers were exactly the same as yours	+1
	If $\geq$ 75% of your workers answers were exactly the same as yours	0
	All other answers	-1

C.4.3-W	If none of your workers have more than 5 people reporting directly to them	+1
	If none of your workers have more than 7 people reporting directly to them	0
	All other answers	-1
C.4.3-EM	If ≤ 5 people report directly to you	+1
	If ≤ 7 > 5 people report directly to you	0
	If > 8 people report directly to you	-1

C.5 Delegation, Authority and Responsibility

C.5.1	If 100% of them have a specific time target	+1
	If < 100% of them have a specific time target	-1
C.5.2	If > six months ago	+1
	All other answers	-1
C.5.3	If > six months ago	+1
	All other answers	-1
C.5.4	If you sent it on without changes	+1
	If you made corrections & personally explained to the drafter why changes were made	0
	All other answers	-1

C.5.5	If it was work that only you could accomplish	0
	If it was work that one of your workers was capable of accomplishing	-1
C.5.6	If all three items have the workers name or initials on it	+1
	If two of the items have the workers name or initials on it	0
	All other answers	-1
C.5.7	If all the calls were switched to workers with first hand knowledge	+1
	If two of the calls were switched to workers with first hand knowledge	0
	All other answers	-1
C.5.8	If you accepted the work the way it was	+1
	If you made minor changes and explained to the worker why you changed it	0
	All other answers	-1
C.5.9	If your worker solved the problem	+1
	If you solved the problem on the spot	0
	If you took the problem for action	-1

C.5.10	If 0%	+1
	If ≤ 25%	0
	If > 25%	-1
C.5.11	If you worked 0 days	+1
	If you worked ≤ 2 days	0
	If you worked > 2 days	-1
C.5.12	If you found a list of delegated items	+1
	All other answers	-1

C.6 Communications

C.6.1	If both items within 1 day	+1
	If both items within 3 days	0
	All other answers	-1
C.6.2	If < 1 hour total per day	+1
	If ≥ 1 hour & ≤ 2 hours total per day	0
	If > 2 hours total per day	-1
C.6.3	If at least three times and workers agreed	+1
	If at least two times and workers agreed	0
	All other answers	-1

C.6.4	If your boss hasn't questioned you	+1
	If only once	0
	All other answers	-1
C.6.5-W	If 100% of your worker's answers were substantially the same as yours	+1
	If $\geq$ 75% of your worker's answers were substantially the same as yours	0
	All other answers	-1
C.6.5-B	If your boss's answer was substantially the same as yours	+1
	All other answers	-1
C.6.6	If all of your workers met a customer within the past month	+1
	If $\geq$ 75% of your workers met a customer within the past month	0
	All other answers	-1
C.6.7-W	If 100% of your worker's answers were substantially the same as yours	+1
	If $\geq$ 75% of your worker's answers were substantially the same as yours	0
	All other answers	-1

C.6.7-B If your boss's answer was substantially the same as yours +1

All other answers -1

C.6.8 If all of your workers received direct feedback within the past month +1

If ≥ 75% of your workers received direct feedback within the past month 0

All other answers -1

C.7 Leadership

C.7.1 If 100% of your work group gives an example of you admitting to a mistake +1

If ≥ 75% of your work group gives an example of you admitting to a mistake 0

All other answers -1

C.7.2 If no one in your work group cites an instance where you got angry +1

All other answers -1

C.7.3 If you remembered all names correctly +1

If you remembered all your workers names 0

All other answers -1

C.7.4 If you could perform all your worker's jobs and the workers all agreed with you +1

If you could perform $\geq$ 75% of your workers jobs and the workers all agreed with you 0

All other answers -1

C.7.5 If you chose the option that avoided even the appearance of impropriety on your part +1

If you chose any other course of action -1

C.7.6 If you chastised in private and none of your workers cited any instance where you chastised in public +1

All other answers -1

C.7.7 If you corrected within one day and none of your workers cited any instance where you took longer +1

If you corrected within three days and none of your workers cited any instance where you took longer 0

All other answers -1

C.7.8	If 100% of workers said yes	+1
	If $\geq$ 75% of workers said yes	0
	All other answers	-1
C.7.9	If you were not late at all and neither were any of your workers	+1
	If you were not late at all and none of your workers were late more than once	0
	All other answers	-1
C.7.10	If all workers average $\leq$ one day per month and your workers answers substantially agree with yours	+1
	If $\geq$ 75% of your workers average $\leq$ one day per month and your workers answers substantially agree with yours	0
	All other answers	-1
C.7.11	If you said yes & all your workers agreed	+1
	If you said yes & $\geq$ 75% of your workers agreed	0
	All other answers	-1
C.7.12	If you graded every worker $\geq$ 9	+1
	If you graded every worker $\geq$ 8	0
	All other answers	-1

C.7.13	If every worker graded your expectations of themselves as $\geq$ 9	+1
	If every worker graded your expectations of themselves as $\geq$ 8	0
	All other answers	-1
C.7.14	If 100% of your answers substantially agree with your workers	+1
	If $\geq$ 75% of your answers substantially agree with your workers	0
	All other answers	-1
C.7.15	If 100% of your answers substantially agree with your workers	+1
	If $\geq$ 75% of your answers substantially agree with your workers	0
	All other answers	-1
C.7.16	If you have done anything or you have no non-performing workers	+1
	All other answers	-1
C.7.17	If < 1 week and all workers agree	+1
	If $\geq$ 1 week & $\leq$ 2 weeks and all workers agree	0
	All other answers	-1

C.7.18	If < 3 days ago and your boss agrees	+1
	If ≥ 3 day & ≤ 5 days ago and your boss agrees	0
	All other answers	-1
C.7.19	If you asked your boss to give direction through you in the future	+1
	All other answers	-1
C.7.20	I commended them for their effort	+1
	I chastised them for their error	-1
	All other answers	0

APPENDIX D

IMPROVEMENT CHECKLIST

D.1 Mission

Your mission statement is the foundation for your work group. Only a clear definition of the mission and purpose of your work group will it make possible for you to set clear and realistic objectives.

- Develop a mission statement for your work group.

Begin by reviewing the following basic tenets of a good mission statement: character, customers, and capabilities.[26]

Your work group's character is its personality. Character describes what the work group stands for. It refers to the internal work group and to the external contributions to which the work group is committed. Character represents the economic as well as noneconomic principles that are the most important to the work group.

Some examples are:[27]

change	cooperation	creativity
delegation	environment	ethics
health	honesty	human development
integrity	product quality	profitability
relationships	risk taking	safety
social responsibility		technological leadership
employment continuity		information sharing

Your work group's customers are the ultimate users of the products or services you produce. You must know <u>who</u> your customers are and what they want to ensure that you are producing the right products or services.

<u>How</u> your work group meets your customer's needs defines your work group's capabilities. To clarify your work group's capabilities, you must prioritize some of the criteria used in producing your product or service such as:[28]

quality	durability	functionality
prestige	cost	consistency
service	flexibility	customer
responsiveness	innovation	creativity
novelty		technology
breadth of product line		

You should now be able to answer the following questions.[29]

- Who are your customers?
- What is value to your customers?
- How are you going to satisfy your customer's wants better than anybody else?
- Which of your customer's wants are not adequately satisfied by the products or services you offer today?
- What <u>is</u> your work group's business?
- What <u>will</u> your work group's business be in the future?
- What <u>should</u> your work group's business be in the future?

Your mission statement can include elements of some or all of the basic tenets. Keep the statement focused. Look at the big picture. One or two sentences is best.

D.2 <u>Objectives</u>

The setting of objectives should always be guided by reference to the mission they are meant to fulfill. Objectives should specify the ends or results that the work group seeks to achieve in concert with it's mission.

- o Develop objectives for your work group.
- o Have each of your workers prepare, with your help, objectives that support the work group objectives.
- o Ensure that the work group and each member of the work group have no more than seven objectives apiece, three to five is optimum. Fully achieving three core objectives is much more productive and satisfying to the worker and the work group than almost achieving ten objectives.
- o Create objectives that:
  - are specific, clear and unambiguous
  - have measurable results
  - support the objectives of the next higher level in the organization
  - are reviewed periodically
  - have a specific time period for accomplishment
  - have specific accountability
  - make possible the concentration of resources and efforts.
  - Are selective rather than all encompassing.

Objectives are not fate; they are direction. They are not commands: they are commitments. They do not

determine the future; they are the means to mobilize the resources and energies of the work group for the making of the future.[30]

D.3 Resources

Resources are people, equipment, materials, tools, and facilities. You must be aware of the resources you are responsible for and the resources your workers need to do their jobs efficiently and effectively. Good practices to follow are:

- Set up a system of accountability for all resources.
- Maintain inventories of all critical, expensive or easily pilfered materials, tools, and equipment.
- Maintain an inventory of all facilities.
- Develop a list of resources that your people are lacking and then strive to obtain them.
- Ensure that the equipment, tools, materials, and spaces you have are being fully utilized.
- Dispose of unused, broken, or antiquated resources.
- Verify the number of people you need to adequately perform your mission. Adjust your

work group to the correct number of people. Too many people can be just as much of a problem as too few.

- o Maintain an informal personnel folder on all your people to aid in promotions and performance appraisals.

D.4 Organization

The simplest organization structure that will do the job is the best one. What makes an organization structure "good" are the problems it does not create. The simpler the structure, the less that can go wrong.

- o Redesign or validate your work groups' organizational structure.

There are three forms of analysis that will help you determine the type of organizational structure needed for the work group: activities analysis, decision analysis, and relations analysis.[31]

Activities Analysis:

- What are the key activities that must be accomplished in order to achieve the work groups' objectives?

- What are the work assignments that must be accomplished in order to complete the key activities.
- Who will accomplish the work assignments?
- What work assignments can logically be grouped together?
- What emphasis is to be given to each key activity in the organization?

This analysis determines what work has to be performed, what work belongs together, and how each key activity should be emphasized in the organization structure.

Decision Analysis:

- What are the key decisions needed to achieve the work groups objectives?
- What activities are involved in or affected by those key decisions?
- On what level of the work group should each key decision be made?
- Who should make the key decisions?
- Who should be consulted prior to the key decisions being made?

- Who should be advised after the fact that a key decision has been made?

Determine the characteristics of the decision by identifying:

- How long into the future the key decision commits the company and how fast the key decision can be reversed?
- What impact the key decision has on other work groups in the organization?
- The qualitative factors such as principles of conduct, ethics, social values, or organizational politics that enter into the decision process?
- Whether the key decisions are recurrent or rare?

This will allow the engineer-manager to determine what decisions should be made and by whom they should be made. Decisions should be made at the lowest level possible in an organization. The shortest path and the least number of workers involved creates the greatest efficiency in decision making.

Relations Analysis:

- What must each worker contribute to the key activities or key decisions?
- With whom is each worker to work?

- What must each worker contribute to programs, and what contributions must other workers make to him or her.
- What is the upward relationship of the worker?
- What is the sideways relationship?

Keep this analysis simple. For a small work group it should take no more than a couple of hours. Creating several charts to visually display the answers to the previous questions will help clarify your organizational situation. This will help highlight the most effective and efficient way to organize your work group.

Organizing then, is a process by which the manager brings order out of chaos, removes conflicts between people over work or responsibility, and establishes an environment suitable for teamwork.[32]

D.5 Delegation, Authority, & Responsibility

Delegation is the process by which managers assign tasks and the authority and responsibility to complete them.[33]

- o Provide your workers with authority sufficient to carry out the tasks for which they are responsible.

- Share the burden with your workers for making sure you both understand what it is you want them to do.
- Delegate only what your workers are ready to handle, plus a little more to stretch their capabilities.
- Keep track of delegations and know their outcomes.
- Give a specific due date for completion, progress report, or recommendation.
- Make it clear that time targets must be met or an extension requested well before the due date.
- Make sure your workers understand that it is their responsibility to keep you up to date about their progress.
- Let workers solve their own problems.
- Delegate everything your workers are capable of handling.
- Delegate and then leave your workers alone.
- Do not modify work your workers have completed for you unless it is absolutely necessary.
- Make sure your workers receive credit for work they have completed for you.
- Do not delegate trivial material or continue to generate useless reports.

- o Get your boss or other parts of your organization to stop requesting unused information or reports.
- o Do not file things you will never use.
- o Get rid of as much paper as possible.

D.6 Communicating

Establishing and maintaining good communications with your workers and your customers is vital to your success as an engineer-manager. Keep the following points in mind:

- o Listen responsively when a worker takes the time to try to talk with you. Eye contact, gestures, and appropriate questions are all important. Taking phone calls, talking with others, or reading something is not listening responsively.
- o Maintain your integrity with your workers above all else. There is no substitute for being completely open and honest with your workers. Your employees must trust you implicitly.
- o Communicate your most important messages face to face and informally.
- o Make sure that you are accessible to your workers. Spend as much of your day as possible

in areas where your workers can find you. Keep the door to your office open. Wander through the areas where your workers spend most of their day.

- o Make certain that you are approachable. Try not to always look busy, preoccupied, or in a hurry.
- o Deliver your communications in the tone, environment and manner which reinforce your message.
- o Use your work group's informal communication channels, "grapevines", judiciously, to communicate some messages.
- o Modify your communications to mesh with the aspirations and values of your workers. Your workers will reject or resist all communications that do not fit in with their values.
- o Ensure your workers are capable of perceiving what it is you are trying to communicate.
- o Use your actions to communicate. Actions do speak louder than words. Your workers will immediately perceive any discontinuity.
- o Encourage positive and negative feedback as a means of understanding your work group's tasks, problems and issues from you workers point of view.

- o Keep your boss continually informed on your work groups progress and problems.
- o Apply all of the above to your communications with your customers.

D.7 Leadership

The most important and least understood of the managerial elements is leadership. Leadership can be developed by observing other managers. Practice your leadership skills at every opportunity. Above all be consistent. There are many different styles of leadership. Your workers will be able to deal with all of them except for the most extreme styles. What your workers will not be able to handle is inconsistency.

- o Support your chain of command. Do not ridicule your superiors or subordinates in front of other workers or managers.
- o Promote your workers accomplishments to your boss, your organization and your customers.
- o Commend your workers publicly and in a timely manner. Do not praise them for everything or when it is not deserved.
- o Demonstrate your integrity to your workers by always making the right decision, not the easy

decision. Say your wrong, don't make excuses. Accept the consequences of your decisions and actions.

- Chastise the laggards in your work group, but do it in private. Let it be known that you do not tolerate low performance.
- Trust your subordinates by pushing responsibility to the lowest level in the chain of command. Give your workers more say in decisions that affect them.
- Encourage your workers to take risks and experiment with new ideas. Do not reprimand workers who fail but encourage them to try again.
- Be an expert in your field. Your workers will follow you much more willingly if they believe you know as much or more about their work than they do.
- Keep things simple by focusing on the crux of any issue or problem. Develop simple, understandable answers. Leave the details for later.
- Be scrupulously honest in all your dealings. Avoid even the appearance of impropriety.
- Make timely decisions. Do not put off decisions for want of the last bit of information.

- Listen to, know, and learn from your workers. Be sensitive to their moods, attitudes and needs to be recognized and appreciated.
- Diffuse conflict by confronting it head on. Encourage working together, rotate jobs, reassign people, but do whatever it takes to end the problem, quickly.
- Admit to your mistakes. Make your workers feel comfortable about admitting to their mistakes by not chastising them for trying to do a good job but failing. Mistakes should be a learning experience. Assigning blame for a mistake is not important.
- Develop a vision for your workers to let them know where they are going and why. Periodically reinforce your mission statement.
- Remain cool under pressure or stress. Encourage those around you to stay calm and act intelligently. Do not remain silent.
- Know when and how to have fun. You must come across to your workers as a real person.
- Invite dissent from your workers. Encourage controversy as an effective method for developing the best solutions to problems. Do not make decisions in a vacuum. Use consensus decision

making when appropriate.

- Set high but achievable performance standards. There must be no room for complacency.
- Put your work groups energies where the results are. Provide opportunities, challenges and the chance to succeed. Do not ignore problems, just do not stress them.
- Express the values and beliefs of your work group when you make people decisions (promotions, demotions, pay, placement). People decisions signal to every worker in your work group what you really want, really value, and really reward.

APPENDIX E

ADDENDUM TO APPENDIX B AND APPENDIX C

E.1 Questions

Replace the corresponding questions in Appendix B with the following:

B.2.1 What are the objectives or end results of your work group?

W/EM _____

_____

_____

_____

B.2.3 What are the written objectives of your boss's organization?

EM/B _____

_____

_____

_____

B.5.8 DELETE

B.5.11 How many Saturdays or Sundays out of the last four weekends have worked on routine work either at home or the office? Do not include regularly scheduled or mandatory weekend work days.

EM _____

B.6.4 DELETE

B.7.1 What was the last mistake you made that adversely affected your work group?

W/EM _____

_____

_____

B.7.4 DELETE

B.7.5 Think of the last time you had the option of doing something that was wrong (against formal or informal rules, but everybody does it) or would appear to be wrong to someone not familiar with the situation. What was it and what did you do?

EM _____

_____

B.7.10 How many total days have you been out sick in the past three months without really being sick?

W/EM _____

B.7.14 DELETE

B.7.15 Do you recognize your workers good performance too much, too little or just about often enough?

W/EM _____

_____

_____

B.7.16 DELETE

B.7.18 DELETE

B.7.20 DELETE

E.2 Review and Evaluation

Replace the corresponding review and evaluation criteria in Appendix C with the following:

C.2.1-B DELETE

C.2.3	If your boss's answer was substantially the same as yours	+1
	If your boss's organization has no written objectives	0
	All other answers	-1
C.3.4	If your boss's answer was the same as your answer	+1
	If your boss's answer was within 10% of your answer	0
	All other answers	-1
C.3.5	If you found a list or an inventory	+1
	If you did not have a list or inventory and you are responsible for less than five spaces	0
	All other answers	-1
C.5.4	If you sent it on without changes	+1
	If you made corrections & personally explained to the drafter why changes were made or you draft all your own letters	0
	All other answers	-1

C.5.5 If it was special project type work that only you could accomplish 0

If it was routine work or work that one of your workers was capable of accomplishing -1

C.5.8 DELETE

C.6.4 DELETE

C.7.1 If 100% of your work group gives an example of you admitting to a mistake +1

If $\geq$ 75% of your work group gives an example of you admitting to a mistake 0

All other answers, including your inability to remember any mistake -1

C.7.4 DELETE

C.7.10 If you and all your workers answer 0. +1

If you answer 0 and $\geq$ 75% of your workers answer 0. 0

All other answers -1

C.7.14 DELETE

C.7.15 If 100% of your workers agree that you recognize them just about enough +1

If ≥ 75% of your workers agree that you recognize them just about enough 0

All other answers -1

C.7.16 DELETE

C.7.17 If < 1 week and all workers agree +1

If ≥ 1 week & ≤ 2 weeks and all workers agree or you do not recognize your workers in writing 0

All other answers -1

C.7.18 DELETE

C.7.20 DELETE